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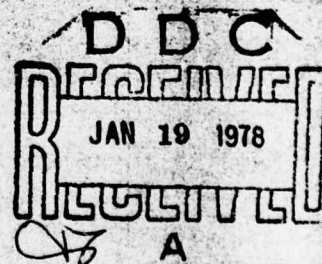
HISTORICAL LIMITS OF THE NORTHERN EDGE OF THE GULF STREAM

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by

Alvan Fisher, Jr.

FEBRUARY 1977



U. S. NAVAL OCEANOGRAPHIC OFFICE
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INTRODUCTION

Knowledge of the position of the Gulf Stream is vital to environmentalists preparing acoustical forecasts in support of fleet operations. The availability of infrared imagery from satellites and bathythermogram messages provide an excellent synoptic overview of the western North Atlantic. Unfortunately, these data frequently cannot be obtained because of environmental or operational problems. Historical data cannot replace synoptic data in this area because of the continuing shift in the Gulf Stream axis and the frequent presence of eddies and meanders. However, historical data can provide statistical information as to the occurrence of the Gulf Stream in any given area. This note examines ocean station data in the western North Atlantic in the rectangle 30° to 40° N, 40° to 75° W and delineates the limits of the northern edge of the Gulf Stream.

PROCEDURE

Data were processed from the ocean station data file on the UNIVAC 1108 computer at the U. S. Naval Oceanographic Office. Cold water observations (i.e., water of polar origin found west and north of the Gulf Stream) were defined as having temperature less than 15° C at a depth of 200 meters west of 50° W and less than 13° C east of 50° W; warm water observations (water of tropical origin found in and south of the Gulf Stream) were defined as having temperature equal to or greater than 15° C at 200 m west of 50° W and 13° C east of 50° W. Criteria used to distinguish between warm and cold water are given in Fisher (1976). The axis of the northern edge of the Gulf Stream was determined by drawing an isopleth through those regions where the number of warm water observations were approximately equal to those in cold water. That area where the northern edge is found 50 percent of the time corresponds to

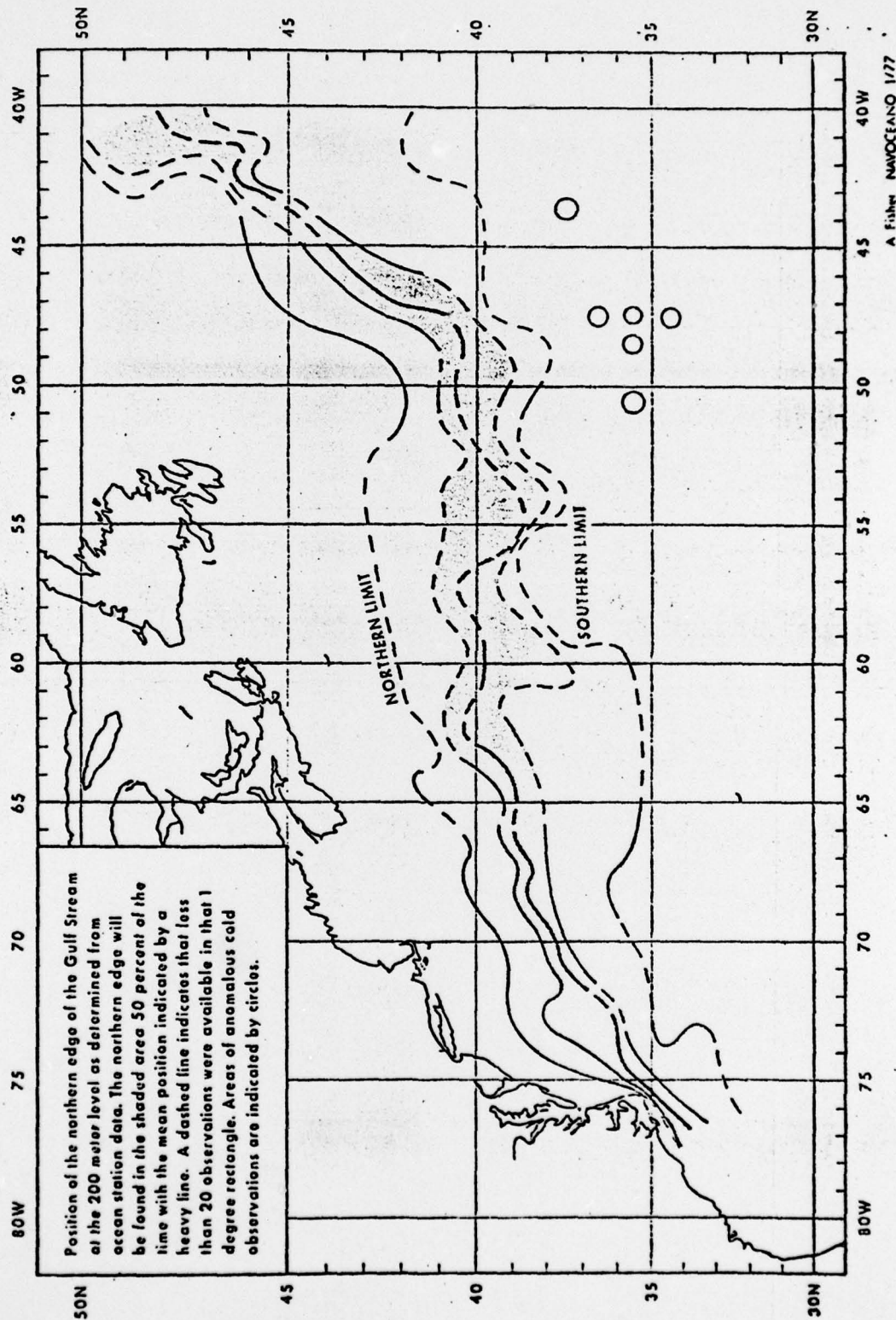
the area where the cold to warm water ratio varied from 1:3 to 3:1. The northern limit of the northern edge was determined by the most northerly limit of warm water. The southern limit was determined as the southern-most limit of cold water except in the eastern portion of the area where several anomalous areas of cold eddies in the central and western portions of the area. Data scarcity in the eastern and southern regions precluded construction of seasonal charts.

RESULTS

The results of the analysis are shown in the attached chartlet, with the area of 50 percent occurrence of the northern edge indicated by shading. Solid isopleths indicate that 20 or more observations per 1-degree rectangle were available for analysis. Location of the northern and southern limits and the axis of the northern edge of the 200-m level in the western half of the area is in agreement with surface data determined from airborne infrared sensors (Fisher, 1973; Khedouri and Gemmill, 1973). Presence of anomalous cold water in the eastern portion of the chart are believed to be a result of southeastward migration of cold eddies.

REFERENCES

- Fisher, A. Environmental Guide to the Virginia Capes, Naval Oceanographic Office, Special Publication SP-211, Washington, 58pp, 1973.
- Selection of water Mass History from Bathythermogram Characteristics, Naval Oceanographic Office, Technical Note 3700-51-76, Washington, 15pp & appendix, 1976.
- Khedouri, E. and W. Gemmill. Statistical Summary of Gulf Stream and Slope Front Characteristics, Naval Oceanographic Office, Technical Note 6150-15-73, 25pp, 1973



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